Funded Projects under Horizon 2020

Secure, clean and efficient energy

Fuel Cells and Hydrogen

Annual Work Plan 2017

FCH 2 JU, institutional PPP

Source: CORDIS – Community Research and Development Information Service (European Commission)
(http://cordis.europa.eu/projects/home_en.html)

Funding and Tender Opportunities Portal (European Commission)
(https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/projects-results)

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This document gives information on calls and funded projects of the EU Framework Programme for Research and Innovation Horizon 2020 for the Societal Challenge – Secure, clean and efficient energy for the year 2016 and 2017.
The data used in this document was extracted from the websites *CORDIS - Information Service* and the *Funding and Tender Opportunities Portal*. More data is available on those websites.

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Topic FCH-01-1-Projects

Topic: FCH-01-1-2017(Transport)	**Acronym:** FLHYSAFE
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Fuel CelL HYdrogen System for AircraFt Emergency operation	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 7,365,901.25 €	**EU max. contribution:** 5,063,023.00 €
Coordinator: SAFRAN POWER UNITS	

Participants:

- INSTITUTO NACIONAL DE TECNICA AEROESPACIAL ESTEBAN TERRADAS
- COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
- ZODIAC AEROTECHNICS SAS
- DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV
- UNIVERSITAET ULM
- ARTTIC

Countries: FR;DE;ES

Objectives:

In order to meet the increasing demand to reduce fuel consumption, Green House Gas emissions as well as operating and maintenance costs, while optimising aircraft performances, fuel cell systems are considered as one of the best options for efficient power generation systems in the context of more electric aircraft (MEA). FLHYSAFE's ambition is to demonstrate that a cost efficient modular fuel cell system can replace the most critical safety systems and be used as an emergency power unit (EPU) aboard a commercial airplane providing enhanced safety functionalities. Additionally the project will virtually demonstrate that the system is able to be integrated into current aircraft designs respecting both installation volumes and maintenance constraints.

In order to shift from demonstrator levels (achieved in other projects such as Antares DLR H2 and FCH HYCARUS), to the ready-to-certify product level, it is necessary to optimise the different components of the fuel cell system to reduce its weight, increase its lifetime, ensure its reliability, certify its safety and make its costs compatible with market requirements.

Within FLHYSAFE a consortium driven by two major aeronautical Tier 1 OEMs will propose fuel cell technologies using PEM fuel cell stacks, more integrated power converters and air bearing compressors. Thanks to the experience of the participants in previous projects, the necessary tests will be carried out in order to demonstrate compatibility to representative environment and safety levels.

Topic FCH-01-2-Projects

Topic: FCH-01-2-2017 (Transport)	**Acronym:** CRESCENDO
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Critical Raw material ElectrocatalystS replacement ENabling Designed pOst-2020 PEMFC	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 2,739,602.50 €	**EU max. contribution:** 2,739,602.50 €
Coordinator: CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	
Participants: ▪ JOHNSON MATTHEY FUEL CELLS LIMITED ▪ BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT ▪ TECHNISCHE UNIVERSITAET BERLIN ▪ IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	▪ COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES ▪ UNIVERSITA DEGLI STUDI DI PADOVA ▪ PRETEXO
Countries: FR;UK;DE;IT	
Objectives: CRESCENDO will develop highly active and long-term stable electrocatalysts of non-platinum group metal (non-PGM) catalysts for the PEMFC cathode using a range of complementary and convergent approaches, and will re-design the cathode catalyst layer so as to reach the project target power density and durability requirements of 0.42 W/cm2 at 0.7 V, and 1000 h with less than 30% performance loss at 1.5 A/cm2 after 1000 h under the FC-DLC, initially in small and ultimately full-size single cells tested in an industrial environment on an industrially scaled-up catalyst. The proposal includes the goal of developing non-PGM or ultra-low PGM anode catalysts with greater tolerance to impurities than current low Pt-loaded anodes. It will develop and apply advanced diagnostics methods and tests, and characterisation tools for determination of active site density and to better understand performance degradation and mass transport losses. The proposal builds on previous achievements in non-PGM catalyst development within all of the university and research organisation project partners. It benefits from the unrivalled know-how in catalyst layer development at JMFC and the overarching expertise at BMW in cell and stack testing, and in guiding the materials development to align with systems requirements.	

Topic: FCH-01-2-2017 (Transport)	**Acronym:** PEGASUS
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: PEMFC based on platinum Group metAl free StrUctured cathodeS	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 2,829,016.88 €	**EU max. contribution:** 2,829,016.88 €
Coordinator: COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	
Participants: ▪ DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV ▪ TECHNISCHE UNIVERSITAET MUENCHEN ▪ AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	▪ ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT DES METHODES ET PROCESSUS INDUSTRIELS ▪ HERAEUS FUEL CELLS GMBH ▪ EWII FUEL CELLS A/S ▪ TOYOTA MOTOR EUROPE NV
Countries: FR, DE, ES, DK, BE	

Objectives:

PEMFC is the fuel cell predilection technology for automotive applications with a large deployment horizon by 2025-30. However, the increasing use of fuel cell electrical vehicles is expected to lead to a quickly growing demand for Platinum Group Metals. PGM production is not only itself related to negative environmental impacts but also raises questions of long-term availability due to the limitation of reserves and Europe’s economic dependence on the countries of the materials’ origin. Hence, it is of strategic importance that the transition to PGM-free catalysts is made as quickly as possible to ensure Europe's competitive position and to reduce market pressure on the use of scarce noble metals.
In that perspective, PEGASUS is exploring the removal of Pt and other critical raw materials and their replacement by non-critical elements enabling efficient and stable electro-catalysis for performing and durable PEMFCs. The overall aim of the project is to bring up the experimental proof of concept for novel catalysts with five underlying objectives supporting a full validation at single cell scale with a focus on the cathode side: 1) High performance, 2) durable and 3) low cost MEA using non-PGM catalysts-based cathode; 4) Robust test protocols for catalysts screening and 5) Understanding of degradation and prevention & mitigation strategies through a MEA design-driven approach.
PEGASUS will benchmark (Metal-Nitrogen-Carbon) materials with variants of Carbon supports and Catalyst Layer designs in order to reach the best compromises between chemical activities and mass/charge transfer with the support of intensive experimentation and modelling. Two generations of non-CRM catalysts will be proposed. GEN1 will implement metals {Fe, Mn or Cu} with Nitrogen onto (1D, 2D and 3D) structured carbon support (single structuration). GEN2 will investigate the enhancement of dual-structuration (1D+3D and 2D+3D) on catalyst stability, reactant availability and water management.

Topic FCH-01-3-Projects

Topic: FCH-01-3-2017 (Transport)	**Acronym:** TAHYA
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: TAnk HYdrogen Automotive	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 3,996,943.75 €	**EU max. contribution:** 3,996,943.75 €
Coordinator: OPTIMUM CPV	
Participants: ▪ ANLEG GMBH ▪ RAIGI SAS ▪ VOLKSWAGEN AG ▪ TECHNISCHE UNIVERSITAET CHEMNITZ	▪ ABSISKEY ▪ BUNDESANSTALT FUER MATERIALFORSCHUNG UND -PRUEFUNG ▪ POLARIXPARTNER GMBH
Countries: BE;DE;FR	

Objectives:

"While automakers have demonstrated progress with prototypes and commercial vehicles traveling greater than 500 km on a single fill, this driving range must be achievable across different vehicle makes and models and without compromising customer expectations of space, performance, safety, or cost.

The TAHYA project, mainly led by industrial partners -already involved in producing and manufacturing hydrogen solutions for the automotive and aviation industry-, will focus on the development of a complete, competitive and innovative European H2 storage system (a cylinder with a mounted On-Tank-Valve with all integrated functionalities) for automotive applications up-performing the actual Asian and US ones.

The TAHYA consortium composed of Optimum CPV, Anleg, Raigi, Volkswagen, Chemnitz University of Technology, Bundesanstalt für Materialforschung und -prüfung, PolarixParner and Absiskey will ensure that the development phase of the storage system remain in line with the expectations (cost, performance and safety) required by the market, end users’ and car manufacturers.

The key objectives of the TAHYA project are:

OBJ#1: Preparatory work to provide a compatible H2 storage system with high performances, safe and Health Safety Environment responsible.

OBJ#2: Provide a compatible H2 storage system with mass production and cost competitive.

OBJ#3: Regulation Codes and Standards (RCS) activities to propose updates on GRT13 and EC79 according to tests results obtained over the duration of the project."

Topic FCH-01-5-Projects

Topic: FCH-01-5-2017 (Transport)	**Acronym:** JIVE 2
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Joint Initiative for hydrogen Vehicles across Europe 2	
Starting date: 01.01.2018	**End date:** 31.12.2023
Total Cost: 105,987,348.00 €	**EU max. contribution:** 25,000,000.00 €
Coordinator: ELEMENT ENERGY LIMITED	
Participants: BRIGHTON & HOVE BUS AND COACH COMPANY LIMITED; CA DE L'AUXERROIS; DUNDEE CITY COUNCIL; ENGIE ENERGIE SERVICES; KOLDING KOMMUNE; OPENBAAR LICHAAM OV-BUREAU GRONINGEN EN DRENTHE; NOORD-BRABANT PROVINCIE; Provincie Zuid-Holland; LANDSTINGET GAVLEBORG; RUTER AS; REGIONALVERKEHR KOLN GMBH	RHEINSCHE BAHNGESSELLSCHAFT AKTIENGESELLSCHAFT; STRAETO BS; SYNDICAT MIXTE DES TRANSPORTS URBAINS DE PAU PORTE DES PYRENEES; HYDROGEN EUROPE; REBELGROUP ADVISORY BV; THINKSTEP AG; UNION INTERNATIONALE DES TRANSPORTS PUBLICS; WSW MOBIL GMBH; RIGAS SATIKSME SIA
Countries: UK;FR;DK;NL;SE;NO;DE;IS;BE;LV	

Objectives:

The spotlight on health impacts of poor air quality and the renewed focus on reducing GHG emissions in recent years provide a strong impetus for cities to seek clean, low carbon transport solutions. When it comes to meeting growing demands for public transport and addressing environmental issues, hydrogen fuel cell (FC) buses offer significant potential.

A commercialisation process for FC buses is underway, through which a shared vision has been agreed between vehicle suppliers and their customers. This is based on reducing costs through scale via a phased approach of pre-commercial demonstrations that will provide the evidence for wider uptake of these vehicles in the 2020s.

The first step in upscaling FC bus deployment is underway through the JIVE project, which began in January 2017. JIVE 2 is its successor and is Europe’s most ambitious FC bus project to date: 152 buses in 14 cities across seven countries. JIVE 2 involves regions with experience of the technology scaling up fuel cell bus fleets (e.g. Cologne), and those seeking to build their knowledge and experience by demonstrating FC buses in small fleets for the first time (e.g. Auxerre, Gävleborg). All deployment locations in JIVE 2 share an ambition to increase the size of their FC bus fleets following successful initial demonstrations, hence the participating cities/regions will be natural locations for larger scale roll-out of the technology in the 2020s.

A comprehensive data monitoring and assessment exercise will capture the relevant evidence to inform next steps for the sector, and the project’s impacts will be maximised by a high-impact dissemination campaign. This will involve reaching wide audiences via various channels, including a series of international Zero Emission Bus Conferences.

The JIVE and JIVE 2 projects together will see the deployment and operation of nearly 300 FC buses in 22 European cities/regions, thus providing a sound basis for further development of this sector.

Topic FCH-01-6-Projects

Topic: FCH-01-6-2017 (Transport)	**Acronym:** ZEFER
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Zero Emission Fleet vehicles For European Roll-out	
Starting date: 01.09.2017	**End date:** 31.08.2022
Total Cost: 25,883,005.00 €	**EU max. contribution:** 4,998,843.00 €
Coordinator: ELEMENT ENERGY LIMITED	
Participants: ▪ SOCIETE DU TAXI ELECTRIQUE PARISIEN ▪ BREATH ▪ AIR LIQUIDE ADVANCED BUSINESS ▪ AIR LIQUIDE ADVANCED TECHNOLOGIES SA ▪ GREEN TOMATO CARS LIMITED ▪ MAYOR'S OFFICE FOR POLICING AND CRIME	▪ ITM POWER (TRADING) LIMITED ▪ CENEX - CENTRE OF EXCELLENCE FOR LOW CARBON AND FUEL CELL TECHNOLOGIES ▪ LINDE AG ▪ BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT ▪ VILLE DE PARIS
Countries: UK;FR;BE;DE	
Objectives: Despite considerable support for the hydrogen mobility sector, there remains low take-up of fuel cell electric vehicles (FCEVs) and vehicle sales remain low. This is a significant issue for the commercialisation of the sector, as whilst sales volumes are low, vehicle production costs and prices remain high. The lack of demand for hydrogen also damages the business case for investment in early hydrogen refuelling stations (HRS). The ZEFER project proposes a solution to this issue. ZEFER will demonstrate viable business cases for captive fleets of FCEVs in operations which can realise value from hydrogen vehicles, for example by intensive use of vehicles and HRS, or by avoiding pollution charges in city centres with applications where the refuelling characteristics of FCEVs suit the duty cycles of the vehicles. ZEFER aims to drive sales of FCEVs in these applications to other cities, thereby increasing sales volumes of FCEVs and improving the business case for HRS serving these captive fleets. ZEFER will deploy 180 FCEVs in Paris, Brussels and London. 170 FCEVs will be operated as taxi or private hire vehicles, and the remaining 10 will be used by the police. The vehicle customers are all partners in the project, so that deployments will occur quickly, (the majority of vehicles will be deployed by the end of 2018) and FCEV mileage will be accumulated rapidly (in Paris and Brussels mileages will be over 90,000 km/year; and in London mileages will be over 40,000 km/year). These applications mean that vehicle performance will be tested to the limit, allowing a demonstration of the technical readiness of new generation FCEVs for high usage applications. The vehicles will be supported by existing and planned HRS. ZEFER will complement these ambitious deployments with robust data collection, analysis of the business cases and technical performance of the deployments. A targeted dissemination campaign will aim to replicate the business cases across Europe.	

Topic FCH-01-7-Projects

Topic: FCH-01-7-2017 (Transport)	**Acronym:** REVIVE
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Refuse Vehicle Innovation and Validation in Europe	
Starting date: 01.01.2018	**End date:** 31.12.2021
Total Cost: 8,706,255.00 €	**EU max. contribution:** 4,993,851.00 €
Coordinator: TRACTEBEL ENGINEERING	
Participants: ▪ SEAB SERVIZI ENERGIA AMBIENTE BOLZANO SPA ▪ AZIENDA SERVIZI MUNICIPALIZZATI DI MERANO SPA ▪ SUEZ NEDERLAND HOLDING BV ▪ GEMEENTE GRONINGEN ▪ GEMEENTE BREDA ▪ STAD ANTWERPEN ▪ SAVER NV	▪ GEMEENTE AMSTERDAM ▪ ELEMENT ENERGY LIMITED ▪ COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES ▪ WATERSTOFNET VZW ▪ SYMBIOFCELL SA ▪ E-TRUCKS EUROPE ▪ SWISS HYDROGEN SA
Countries: BE;IT;NL;UK;FR;CH	
Objectives: REVIVE will significantly advance the state of development of fuel cell refuse trucks, by integrating fuel cell powertrains into 15 vehicles and deploying them in 8 sites across Europe. The project will deliver substantial technical progress by integrating fuel cell systems from three major suppliers and developing effective hardware and control strategies to meet highly demanding refuse truck duty cycles. Specific work on standardisation will ensure that the lessons learned are applicable to the full range of OEMs supplying vehicles into the European market, helping to accelerate the introduction of next generation products. In parallel, the demonstration activities will greatly raise awareness of the viability of fuel cells as a solution to demanding heavy duty vehicle uses (and raise public awareness of hydrogen mobility more generally due to the visibility of the trucks). A successful demonstration of fuel cell trucks will have substantial impacts beyond the technical progress delivered by the project itself, as it will enable public authorities to continue implementing bold decarbonisation strategies by providing clear evidence that viable zero emissions solutions will exist for all vehicle types in the medium term. The project will also support the wider rollout of hydrogen mobility by introducing a further source of hydrogen demand that can improve the economics of existing and future refuelling station deployments, in turn facilitating the rollout of other vehicle types.	

Topic FCH-02-1-Projects

Topic: FCH-02-1-2017 (Energy)	**Acronym:** PRETZEL
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Novel modular stack design for high pressure PEM water electrolyzer technology with wide operation range and reduced cost	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 1,999,088.75 €	**EU max. contribution:** 1,999,088.75 €
Coordinator: DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	
Participants: ▪ WESTFALISCHE HOCHSCHULE GELSENKIRCHEN, BOCHOLT, RECKLINGHAUSEN ▪ ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT DES METHODES ET PROCESSUS INDUSTRIELS ▪ UNIVERSITATEA POLITEHNICA TIMISOARA	▪ ADAMANT AERODIASTIMIKES EFARMOGES ETAIREIA PERIORISMENIS EFTHYNIS ▪ GKN SINTER METALS FILTERS GMBH RADEVORMWALD ▪ ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS ▪ SOLUCIONES CATALITICAS IBERCAT SL ▪ IGAS ENERGY GMBH
Countries: DE;FR;RO;EL;ES	
Objectives: Green hydrogen produced by electrolysis might become a key energy carrier for the implementation of renewable energy as a cross-sectional connection between the energy sector, industry and mobility. Proton exchange membrane (PEM) electrolysis is the preferred technology for this purpose, yet large facilities can hardly achieve FCH-JU key performance indicators (KPI) in terms of cost, efficiency, lifetime and operability. Consequently, a game changer in the technology is necessary. PRETZEL consortium will develop a 25 kW PEM electrolyzer system based on a patented innovative cell concept that is potentially capable of reaching 100 bar differential pressure. The electrolyzer will dynamically operate between 4 and 6 A cm^(-2) and 90 °C achieving an unprecedented efficiency of 70%. This performance will be maintained for more than 2000 h of operation. Moreover, the capital cost of stack components will be largely reduced by the use of non-precious metal coatings and advanced ceramic aerogel catalyst supports. Likewise, the system balance of plant (BoP) will be optimized for cost reduction and reliability. The high pressure hydrogen generator will become part of the product portfolio of a German manufacturer but at the end of PREZEL, this company will establish a supply business partnership and R&D collaboration with France, Spain, Greece and Rumania, strengthening and consolidating cooperation among EU states with contrasting economies. Lastly, the hydrogen produced by the PEM electrolyzer will not be wasted, but rather used for feeding the fuel cell test stations in one of the partner's laboratory.	

Topic: FCH-02-1-2017 (Energy)	**Acronym:** NEPTUNE
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Next Generation PEM Electrolyser under New Extremes	
Starting date: 01.02.2018	**End date:** 31.01.2021
Total Cost: 1,927,335.43 €	**EU max. contribution:** 1,926,221.25 €
Coordinator: ITM POWER (TRADING) LIMITED	
Participants: ▪ ENGIE ▪ SOLVAY SPECIALTY POLYMERS ITALY SPA ▪ CONSIGLIO NAZIONALE DELLE RICERCHE ▪ EWII FUEL CELLS A/S ▪ PRETEXO	
Countries: UK;FR;IT;DK	

Objectives:

Water electrolysis supplied by renewable energy is the foremost technology for producing “green” hydrogen for fuel cell vehicles. The ability to follow rapidly an intermittent load makes this an ideal solution for grid balancing. To achieve large-scale application of PEM electrolysers, a significant reduction of capital costs is required together with a large increase of production rate and output pressure of hydrogen, while assuring high efficiency and safe operation. To address these challenges, a step-change in PEM electrolysis technology is necessary.

The NEPTUNE project develops a set of breakthrough solutions at materials, stack and system levels to increase hydrogen pressure to 100 bar and current density to 4 A cm-2 for the base load, while keeping the nominal energy consumption <50 kWh/kg H2. The rise in stack temperature at high current density will be managed by using Aquivion® polymers for both membrane and ion exchange resin. Aquivion® is characterised by enhanced conductivity, high glass transition temperature and increased crystallinity. Dramatic improvements in the stack efficiency will be realised using novel thin reinforced membranes, able to withstand high differential pressures. An efficient recombination catalyst will solve any gas crossover safety issues. Newly developed electro-catalysts with increased surface area will promote high reaction rates. The novel solutions will be validated by demonstrating a robust and rapid-response electrolyser of 48 kW nominal capacity with a production rate of 23 kg H2/day. The aim is to bring the new technology to TRL5 and prove the potential to surpass the 2023 KPIs of the MAWP 2017. The proposed solutions contribute significantly to reducing the electrolyser CAPEX and OPEX costs.

The project will deliver a techno-economic analysis and an exploitation plan to bring the innovations to market. The consortium comprises an electrolyser manufacturer, suppliers of membranes, catalysts and MEAs and an end-user.

Topic FCH-02-2-Projects

Topic: FCH-02-2-2017 (Energy)	**Acronym:** GAMER
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Game changer in high temperature steam electrolysers with novel tubular cells and stacks geometry for pressurized hydrogen production	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 2,998,951.25 €	**EU max. contribution:** 2,998,951.25 €
Coordinator: STIFTELSEN SINTEF	
Participants: ▪ COORSTEK MEMBRANE SCIENCES AS ▪ AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	▪ CRI EHF ▪ UNIVERSITETET I OSLO ▪ MC2 INGENIERIA Y SISTEMAS SL ▪ SHELL GLOBAL SOLUTIONS INTERNATIONAL BV
Countries: NO;ES;IS;NL	
Objectives: The GAMER project will develop a novel cost-effective tubular Proton Ceramic Electrolyser (PCE) stack technology integrated in a steam electrolyser system to produce pure dry pressurized hydrogen. The electrolyser system will be thermally coupled to renewable or waste heat sources in industrial plants to achieve higher AC electric efficiency and efficient heat valorisation by the integrated processes. The project will establish high volume production of the novel tubular proton conducting ceramic cells. The cells will be qualified for pressurized steam electrolysis operation at intermediate temperature (500-700°C). They will be bundled in innovative single engineering units (SEU) encased in tubular steel shells, a modular technology, amenable to various industrial scales. GAMER will develop designs of system and balance of plant components supported by advanced modelling and simulation work, flowsheets of integrated processes, combined with robust engineering routes for demonstrating efficient thermal and electrical integration in a 10 kW electrolyser system delivering pure hydrogen at minimum 30 bars outlet pressure. The consortium covers the full value chain of the hydrogen economy, from cell and SEU manufacturer (CMS), system integrators (MC2, CRI), through researchers (SINTEF, UiO, CSIC), to end users in refineries, oil and gas, chemical industry (CRI, Shell with advisory board members YARA and AirLiquide). All along the project, these experienced partners will pay particular attention to risk management (technical, economic, logistic, business) and ensure progress of the technology from TRL3 to TRL5. The overall consortium will perform strategic communication with the relevant stakeholders in order to ensure strong exploitation of the project's results.	

Topic FCH-02-3-Projects

Topic: FCH-02-3-2017 (Energy)	**Acronym:** REFLEX
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Reversible solid oxide Electrolyzer and Fuel cell for optimized Local Energy miX	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 2,999,575.48 €	**EU max. contribution:** 2,999,575.25 €
Coordinator: COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	
Participants: ▪ DANMARKS TEKNISKE UNIVERSITET ▪ Teknologian tutkimuskeskus VTT Oy ▪ GREEN POWER TECHNOLOGIES SL ▪ AKTSIASELTS ELCOGEN	▪ SYLFEN ▪ ENGIE ▪ PARCO SCIENTIFICO E TECNOLOGICO PER L'AMBIENTE - ENVIRONMENT PARK SPA ▪ UNIVERSIDAD DE SEVILLA
Countries: FR;DK;FI;ES;EE;IT	
Objectives: The REFLEX project aims at developing an innovative renewable energies storage solution, the “Smart Energy Hub”, based on reversible Solid Oxide Cell (rSOC) technology, that is to say able to operate either in electrolysis mode (SOEC) to store excess electricity to produce H2, or in fuel cell mode (SOFC) when energy needs exceed local production, to produce electricity and heat again from H2 or any other fuel locally available. The challenging issue of achieving concomitantly high efficiency, high flexibility in operation and cost optimum is duly addressed through improvements of rSOC components (cells, stacks, power electronics, heat exchangers) and system, and the definition of advanced operation strategies. The specifications, detailed system design and the advanced operation strategies are supported by modelling tasks. An in-field demonstration will be performed in a technological park, where the Smart Energy Hub will be coupled to local solar and mini-hydro renewable sources and will provide electricity and heat to the headquarters of the park. It will demonstrate, in a real environment, the high power-to-power round-trip efficiency of this technology and its flexibility in dynamic operation, thus moving the technology from Technology Readiness Level (TRL) 3 to 6. The Smart Energy Hub being modular, made of multistacks/multimodules arrangements, scale up studies will be performed to evaluate the techno-economic performance of the technology to address different scales of products for different markets. To reach these objectives, REFLEX is a cross multidisciplinary consortium gathering 9 organisations from 6 member states (France, Italy, Denmark, Estonia, Spain, Finland). The partnership covers all competences necessary: cells and stacks development and testing (ELCOGEN, CEA, DTU), power electronics (USE, GPTech), system design and manufacturing (SYLFEN), system modelling (VTT), field test (Envipark), techno-economical and market analysis (ENGIE).	

Topic FCH-02-4-Projects

Topic: FCH-02-4-2017 (Energy)	**Acronym:** Haeolus
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Hydrogen-Aeolic Energy with Optimised eLectrolysers Upstream of Substation	
Starting date: 01.01.2018	**End date:** 31.12.2021
Total Cost: 7,474,090.74 €	**EU max. contribution:** 4,997,738.63 €
Coordinator: SINTEF AS	
Participants: ▪ COMMUNAUTE D' UNIVERSITES ET ETABLISSEMENTS UNIVERSITE BOURGOGNE - FRANCHE - COMTE ▪ NEW NEL HYDROGEN AS ▪ FUNDACION TECNALIA RESEARCH & INNOVATION	▪ UNIVERSITA DEGLI STUDI DEL SANNIO ▪ VARANGER KRAFTVIND AS ▪ KES KNOWLEDGE ENVIRONMENT SECURITY SRL ▪ STIFTELSEN SINTEF
Countries: NO;FR;ES;IT	

Objectives:

The Haeolus project will install two electrolysers with a combined capacity of 2 MW in the remote region of Varanger, Norway, inside the Raggovidda wind farm, whose growth is limited by grid bottlenecks.

The electrolysers will be one alkaline and one PEM-based, to demonstrate both technologies and their synergies. They will be integrated with the wind farm, hydrogen storage and a smaller fuel cell for re-electrification.

To maximise relevance to wind farms across the EU and the world, the plant will be operated in multiple emulated configurations (energy storage, mini-grid, fuel production).

Like many large wind farms, especially offshore, Raggovidda is difficult to access, in particular in winter: Haeolus will therefore deploy a remote monitoring and control system allowing the system to operate without personnel on site.

Maintenance requirements will be minimised by a specially developed diagnostic and prognostic system for the electrolysers and BoP systems.

The containerised electrolysers are standard models carried by project partner NEL and their recently acquired subsidiary Proton OnSite. The integrated system will be housed in a specially erected hall to protect it from the Arctic winter and allow year-round access.

The integrated system of electrolysers, fuel cells, and wind farm will be designed for flexibility in demonstration, to allow emulating different operating modes and grid services.

Haeolus answers the AWP's challenge with the widest possible project scope, with both main electrolyser technologies represented on the site, operation modes not limited to the site's particular needs but extended to all major use cases, and several in-depth analyses (released as public reports) on the business case of electrolysers in wind farms, their impact on energy systems and the environment, and their applicability in a wide range of conditions.

Topic FCH-02-5-Projects

Topic: FCH-02-5-2017 (Energy)	**Acronym:** REFHYNE
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Clean Refinery Hydrogen for Europe	
Starting date: 01.01.2018	**End date:** 31.12.2022
Total Cost: 16,058,562.50 €	**EU max. contribution:** 9,998,043.50 €
Coordinator: STIFTELSEN SINTEF	
Participants: ▪ SHELL ENERGY EUROPE LIMITED ▪ SHELL DEUTSCHLAND OIL GMBH	▪ ITM POWER (TRADING) LIMITED ▪ THINKSTEP AG ▪ ELEMENT ENERGY LIMITED
Countries: NO;UK;DE	

Objectives:

The REFHYNE project will install and operate a 10MW electrolyser from ITM Power at a large refinery in Rhineland, Germany, which is operated by Shell Deutschland Oils. The electrolyser will provide bulk quantities of hydrogen to the refinery's hydrogen pipeline system (currently supplied by two steam methane reformers). The electrolyser will be operated in a highly responsive mode, helping to balance the refinery's internal electricity grid and also selling Primary Control Reserve service to the German Transmission System Operators.

The combination of hydrogen sales to the refinery and balancing payments create a business case which justifies this installation. This business case will be evaluated in detail, in a 2 year campaign of techno-economic and environmental analysis.

The REFHYNE business model is replicable in markets with a similar regulatory structure to Germany. However, to expand this market to a GW scale, new business models will be needed. These will include valuing green hydrogen as an input to industrial processes (to meet carbon policy targets) and also on sales to H2 mobility markets. The REFHYNE project will gather real world data on these models and will use this to simulate the bulk electrolyser model in a range of market conditions. This will be used to produce reports on the conditions under which the electrolyser business models become viable, in order to provide the evidence base required to justify changes in existing policies. A campaign of targeted dissemination will ensure the results of these studies reach decision makers in large industrial sites, financiers, utilities and policy makers.

The REFHYNE electrolyser will be the largest in the world and has been designed as the building block for future electrolysers up to 100MW and beyond. REFHYNE includes a design study into the options for a 100MW electrolyser at the Rhineland refinery, which will help prepare the market for deployments at this scale.

Topic FCH-02-6-Projects

Topic: FCH-02-6-2017 (Energy)	**Acronym:** HySTOC
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Hydrogen Supply and Transportation using liquid Organic Hydrogen Carriers	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 2,499,921.25 €	**EU max. contribution:** 2,499,921.25 €
Coordinator: HYDROGENIOUS TECHNOLOGIES GMBH	
Participants: ▪ HYGEAR BV ▪ OY WOIKOSKI AB ▪ Teknologian tutkimuskeskus VTT Oy	▪ FRIEDRICH-ALEXANDER-UNIVERSITAET ERLANGEN NUERNBERG
Countries: DE;NL;FI	
Objectives: Hydrogen is a versatile energy carrier that will allow the EU to accomplish its strategic targets of zero-emission mobility, integration of renewables and the decarbonisation of industry. However, its low density and explosive nature make hydrogen storage and transport technically challenging, inefficient and very expensive. The Liquid Organic Hydrogen Carrier (LOHC) technology enables safe and efficient high-density hydrogen storage in an easy-to-handle oil, thus eliminating the need for pressurized tanks for storage and transport. The HySTOC project will demonstrate LOHC-based distribution of high purity hydrogen (ISO 14687:2-2012) to a commercially operated hydrogen refueling station (HRS) in Voikoski, Finland, in an unprecedented field test. Dibenzyltoluene, the LOHC material used within HySTOC is not classified as a dangerous good, is hardly flammable and offers a five-fold increase in storage capacity compared with standard high pressure technology, leading to a transport cost reduction of up to 80%. HySTOC comprises 5 partners (including 2 SMEs, 1 industrial and 2 scientific partners) from 3 European countries (Finland, Germany, The Netherlands). The partners cover the whole value chain from basic research and testing (FAU & VTT) through core technology development (Hydrogenious Technologies and HyGear) to the end-user that will operate the LOHC-based hydrogen infrastructure (Woikoski). The comprehensive and complementary mixture of expertise and know-how provided by the consortium ensures not only an efficient realization of the technical and (pre)commercial objectives of the project, but also the subsequent dissemination and exploitation of the achieved results to maximize its impact within the consortium and the hydrogen market as a whole. In the long term, the LOHC technology developed within HySTOC will allow integration of renewable energy by making it available to hydrogen mobility in an easy-to-handle form and will thus help decarbonize the world.	

Topic FCH-02-7-Projects

Topic: FCH-02-7-2017 (Energy)	**Acronym:** GRASSHOPPER
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: GRid ASsiSting modular HydrOgen Pem PowER plant	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 4,387,063.75 €	**EU max. contribution:** 4,387,063.75 €
Coordinator: INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO	
Participants: ▪ NEDSTACK FUEL CELL TECHNOLOGY BV ▪ JOHNSON MATTHEY FUEL CELLS LIMITED ▪ ABENGOA INNOVACION SOCIEDAD ANONIMA	▪ ZENTRUM FUR BRENNSTOFFZELLEN-TECHNIK GMBH ▪ POLITECNICO DI MILANO
Countries: SI;NL;UK;ES;DE;IT	

Objectives:

The GRASSHOPPER project aims to create a next-generation MW-size Fuel Cell Power Plant unit (FCPP), which is more cost-effective and flexible in power output, accomplishing an estimated CAPEX below 1500 EUR/kWe at a yearly production rate of 25 MWe.

Large MW size PEM FCPP have been demonstrated, such as in the DEMCOPEM-2MW project, however at too high Capex level and without dynamic operation features for grid support. Grasshopper tackles these issues enabling a controlled, renewables-based energy infrastructure.

The power plant will be demonstrated in the field as 100 kW sub-module pilot plant, implementing newly developed stacks, MEA's and BoP system components, combining benefits of coherent design integration.

Cost and technical optimisation will be achieved with improvements targeting MEAs (increasing current density, active area, reducing material costs incl. Pt loading), stack design (increasing stack size, power density and operating pressures, while streamlining manufacturability) and overall system balance of plant (modular design, simplified header and manifolds for gas distribution, high efficiency PV inverters, using off-the-shelf equipment where possible).

This unit will be operated continuously for 8 months in industrially-relevant environment for engaging grid support modulation as part of an established on-site Demand Side Management (DSM) programme.

This consortium unites component suppliers (JMFC, NFCT), research institutions (ZBT, Polimi) and integrators (AI, INEA) who will partner with existing energy market stakeholders (DSO, TSO) and EU smart grid projects committed to participate as advisory board members. This collaboration maximises the business case value proposition, by ensuring the delivered technology will respond to grid services' requirements for flexible dynamic power operation. Innovative DSM programmes will be completed to establish the best path forward for commercialization of the technology for a fast response FCPP.

Topic FCH-02-8-Projects

Topic: FCH-02-8-2017 (Energy)	**Acronym:** MAMA-MEA
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Mass Manufacture of MEAs Using High Speed Deposition Processes	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 3,189,816.00 €	**EU max. contribution:** 3,189,816.00 €
Coordinator: TECHNISCHE UNIVERSITAET CHEMNITZ	
Participants: ▪ UNIVERSITA DEGLI STUDI DI MODENA E REGGIO EMILIA ▪ FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. ▪ JOHNSON MATTHEY FUEL CELLS LIMITED	▪ SYSTEM SPA ▪ INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO ▪ NEDSTACK FUEL CELL TECHNOLOGY BV
Countries: DE;IT;UK;SI;NL	
Objectives: The market for PEM fuel cells will increase to 10's GWs per annum from 2025. For the catalyst coated membrane (CCM), a critical stack component, continuous manufacturing processes are currently being implemented by manufacturers worldwide. Whilst these will meet CCM demand for the next 10 years, the growing requirement for increased numbers of CCMs thereafter necessitates a manufacturing step-change, both in terms of cost and capacity. MAMA-MEA will address this by assembling a consortium with extensive knowledge and expertise both of fuel cell technology and manufacturing in the digital coating and printed electronic industry, to develop the highly innovative concept of an additive layer manufacturing (ALM) process for the edge-sealed CCM. The key CCM components (anode and cathode catalyst layers, ion-conducting membrane and edge seals) will be deposited with high precision and speed, one component layer on top of the other, and just in the areas of the CCM where they are required for functionality. Preliminary one-off prototypes have established the feasibility of the approach, and patent applications have been filed. MAMA-MEA will develop this innovative ALM process from MRL3 to MRL 6, by integrating the CCM components in to a single continuous roll-to-roll manufacturing process and validating the sealed CCMs in two full-size stationary application PEM fuel cell stacks. A key project objective will be an increase in the manufacturing rate of over 10 times compared to the state-of-the-art process, whilst also increasing material utilisation to 99%, and the product quality, and thus yield, to over 95%. Overall, sealed CCM direct materials and manufacturing costs will be reduced by up to 58% in the new CCMs. The project will also conduct comprehensive ex-situ characterisation and in-situ fuel cell performance and durability testing and provide an engineering design of an ALM sealed CCM production line, including quality control methodologies.	

Topic FCH-02-9-Projects

Topic: FCH-02-9-2017 (Energy)	**Acronym:** OxiGEN
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Next-generation Solid Oxide Fuel Cell stack and hot box solution for small stationary applications	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 2,996,873.75 €	**EU max. contribution:** 2,996,873.75 €
Coordinator: SOCIETE EUROPEENNE DES PRODUITS REFRACTAIRES	
Participants: ▪ ICI CALDAIE SPA ▪ FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. ▪ EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV	▪ COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES ▪ STIFTELSEN SINTEF ▪ ENGIE
Countries: FR;IT;DE;NO	

Objectives:

OxiGEN aims at developing an innovative SOFC technical platform, including an all-ceramic stack design and a modular hotbox, for small stationary applications. Thanks to its higher durability and simpler design, this novel stack can fulfill the customers' needs for long lifetime, high efficiency and low cost, in micro-CHP and other segments.

A broad pan-European consortium of seven major players (ICI Caldaie, R&D centers Fraunhofer-IKTS, EIFER, CEA Liten, SINTEF, utility ENGIE, global ceramist and project coordinator Saint-Gobain) will partner to integrate the all-ceramic stack into an original hot box solution. Functional specifications will be set by a qualified Advisory Panel, gathering European system integrators and gas utilities in addition to the JRC and other consortium members. The solution's design will be modular and will address the specifications and standards suggested by the Advisory Panel, in order to provide a technical platform serving several market segments while fostering open competition between industry players. This new platform is of European ownership and leverages a European supply chain, thus supporting the emergence of a European fuel cell industry fully independent from Asian fuel cell technology.

The projects' technical objectives address all the call challenges:

• Define, with input from the Advisory Panel, the most suitable hotbox functional specifications for residential and commercial segments

• Develop a higher power stack to reach the call's technical targets

• Develop a modular hot box concept and build a 1kWe prototype (in practice, 500We to 1500We depending on preferred micro-CHP power specification)

• Assess the performance of the prototype in system-like conditions

• Study the cost-of-ownership of the solution

• Propose material-based solutions for future long-term improvements

• Ensure the manufacturability and compatibility of the new hotbox with the EU supply chain

• Disseminate results and build the exploitation plan

Topic FCH-02-10-Projects

Topic: FCH-02-10-2017 (Energy)	**Acronym:** EVERYWH2ERE
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Making hydrogen affordable to sustainably operate Everywhere in European cities	
Starting date: 01.02.2018	**End date:** 31.01.2023
Total Cost: 6,762,324.46 €	**EU max. contribution:** 4,999,945.76 €
Coordinator: RINA CONSULTING SPA	
Participants: ▪ Teknologian tutkimuskeskus VTT Oy ▪ Powercell Sweden AB ▪ GENPORT SRL - SPIN OFF DEL POLITECNICO DI MILANO ▪ SWISS HYDROGEN SA ▪ MAHYTEC SARL ▪ FUNDACION PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGIAS DEL HIDROGENO EN ARAGON	▪ DELTA1 GUG (HAFTUNGSBESCHRANKT) ▪ PARCO SCIENTIFICO TECNOLOGICO PER LAMBIENTE ENVIRONMENT PARK TORINO SPA ▪ ACCIONA CONSTRUCCION SA ▪ ICLEI EUROPEAN SECRETARIAT GMBH (ICLEI EUROPASEKRETARIAT GMBH)* ▪ LINDE GAS ITALIA SRL
Countries: IT;FI;SE;CH;FR;ES;DE	
Objectives: "European cities can become living lab for the demonstration of Fuel cell and hydrogen technologies, starting from their use in niche, but everyday applications such as temporary gensets that are used in construction sites, music festivals and temporary events. .Leveraging EU excellent knowledge from consortium partners in FC application for automotive and telecom backup power solutions, EVERYWH2ERE project will integrate already demonstrated robust PEMFC stacks and low weight intrinsecallty safe pressurized hydrogen technologies into easy to install, easy to transport FC based transportable gensets. 8 FC containerd “plug and play”gensets will be realized and tested through a pan-European demonstration campaign in a demonstration to market approach.The prototypes will be tested in construction sites, music festivals and urban public events all around Europe, demonstrating their flexibility and their.enlarged lifetime. Demonstration results will be capitalized towards the redaction of three replicability studies for the use of the gensets in new contexts (emergency and reconstruction sites, ships cold ironing in harbors, mining industrial sites) and for the definition of a commercial roadmap and suitable business model for the complete marketability of the gensets within 2025. A detailed logistic and environmental analysis will be performed in order to study the complete techno-economic viability of the gensets and a decision support tool will be realized to support end-users in future replicability. According to the crucial role of cities to promote through policies and dedicated regulatory framework the spreading of FC gensets, local authorities will be involved in the project since its beginning. A strong dissemination and communication campaign will be conducted particularly during ""demonstration events"" (more than 25 festivals involved) in order to increase public audience awareness about FCH technologies."	

Topic FCH-02-11-Projects

Topic: FCH-02-11-2017 (Energy)	**Acronym:** ComSos
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Commercial-scale SOFC systems	
Starting date: 01.01.2018	**End date:** 30.06.2021
Total Cost: 10,277,897.50 €	**EU max. contribution:** 7,486,954.75 €
Coordinator: Teknologian tutkimuskeskus VTT Oy	
Participants: ▪ SUNFIRE GMBH ▪ CONVION OY ▪ POLITECNICO DI TORINO	▪ ENERGY MATTERS BV ▪ SOLIDPOWER SPA ▪ HTceramix SA
Countries: FI;DE;IT;NL;CH	

Objectives:

The ComSos project aims at strengthening the European SOFC industry's world-leading position for SOFC products in the range of 10-60 kW totally 450 kWe. Through this project, manufacturers prepare for developing capacity for serial manufacturing, sales and marketing of mid FC CHP products. All manufacturers will validate new product segments in collaboration with the respective customers and confirm product performance, the business case and size, and test in real life the distribution channel including maintenance and service. In function of the specific segments, the system will be suitable for volumes from few 10's to several 1,000 systems per year.

The key objective of the ComSos project is to validate and demonstrate fuel cell based combined heat and power solutions in the mid-sized power ranges of 10-12 kW, 20-25 kW, and 50-60 kW (referred to as Mini FC-CHP). The outcome gives proof of the superior advantages of such systems, underlying business models, and key benefits for the customer. The technology and product concepts, in the aforementioned power range, has been developed in Europe under supporting European frameworks such as the FCH-JU.

The core of the consortium consists of three SOFC system manufacturers aligned with individual strategies along the value chain: Convion (two units of 60kWe each), SOLIDpower (15 units of 12kWe each) and Sunfire (6-8 units of 25kWe each). End-users and distributors have also expressed strong interest in the products, and will be actively involved in the ComSos project by participation in the Advisory Board.

Topic FCH-02-12-Projects

Topic: FCH-02-12-2017 (Energy)	**Acronym:** REMOTE
Call: H2020-JTI-FCH-2017-1	**Type of Action:** IA
Title: Remote area Energy supply with Multiple Options for integrated hydrogen-based TEchnologies	
Starting date: 01.01.2018	**End date:** 31.12.2021
Total Cost: 6,761,557.50 €	**EU max. contribution:** 4,995,950.25 €
Coordinator: POLITECNICO DI TORINO	
Participants: ▪ BALLARD POWER SYSTEMS EUROPE AS ▪ HYDROGENICS EUROPE NV ▪ POWIDIAN ▪ ENEL GREEN POWER ▪ ORIZWN ANONYMH TECHNIKI ETAIREIA	▪ IRIS SRL ▪ TRONDERENERGI AS ▪ EPS ELVI ENERGY S.R.L. ▪ STIFTELSEN SINTEF ▪ ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
Countries: IT;DK;BE;FR;EL;NO	
Objectives: REMOTE will demonstrate technical and economic feasibility of two fuel cells-based H2 energy storage solutions (integrated P2P system; non-integrated P2G+G2P system), deployed in 4 DEMOs, based on renewables, in isolated micro-grid or off grid remote areas. DEMO 1: Ginostra (South Italy): off-grid configuration (island); RES based on hybrid system with PV- generators; residential loads on-site; almost complete substitution of fossil fuels. End-user: ENEL Green Power utility; DEMO 2: (Greece): isolated micro-grid application; RES based on hydro generators; industrial (SME) loads onsite; complete substitution of fossil fuels; avoid costs for new transmission line. End-user: Horizon SA owner of hydro plant; DEMO 3: Ambornetti (North Italy): off-grid configuration (remote Alps); RES based on hybrid system with PV-biomass CHP generators; residential loads on-site; complete substitution of fossil fuels. End-user: IRIS stakeholder of the hamlet; DEMO 4: Froan Island (Norway): isolated micro-grid application; RES based on hybrid system with PV-wind generators; residential loads+ fish industry on-site; complete substitution of fossil fuels; avoid costs for new transmission line. End-user: Trønder Energi utility. VALIDATE the 4 DEMO units, to enable suppliers, end-users and general stakeholders to gain experience throughout the value chain of the energy storage; DEMOSTRATE the added value of the fuel cell-based H2 energy storage solutions with respect to alternative technologies in terms of economics, technical and environmental benefits; VALIDATE EU-based sub-MW P2P manufacturing solutions to fill the gap in the European energy storage sector while utilising the existing EU know-how already developed in previous consortium among partners; EXPLOITATION and BUSINESS scenarios for the replication of P2P solutions, considering different typologies of micro-grids (isolated or not); DISSEMINATION, build up confidence among stakeholders and raise public interest.	

Topic FCH-04-1-Projects

Topic: FCH-04-1-2017 (Cross-cutting)	**Acronym:** HYDRAITE
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Hydrogen Delivery Risk Assessment and Impurity Tolerance Evaluation	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 3,499,867.50 €	**EU max. contribution:** 3,499,867.50 €
Coordinator: Teknologian tutkimuskeskus VTT Oy	
Participants: ▪ ZENTRUM FUR SONNENENERGIE- UND WASSERSTOFF-FORSCHUNG BADEN-WURTTEMBERG ▪ ZENTRUM FUR BRENNSTOFFZELLEN-TECHNIK GMBH	▪ STIFTELSEN SINTEF ▪ COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES ▪ Powercell Sweden AB ▪ NPL MANAGEMENT LIMITED
Countries: FI;NO;FR;SE;UK;DE	
Objectives: HYDRAITE project aims to solve the issue of hydrogen quality for transportation applications with the effort of partners from leading European research institutes and independent European automotive stack manufacturer, together with close contact and cooperation with the European FCH industry. In this project, the effects of contaminants, originating from the hydrogen supply chain, on the fuel cell systems in automotive applications are studied. As an outcome, recommendations for the current ISO 14687 standards will be formulated based on the technical data of the impurity concentrations at the HRS, FC contaminant studies under relevant automotive operation conditions, and inter-compared gas analysis. The methodology for determining the effect of contaminants in automotive PEMFC system operation will be developed by six leading European research institutes in co-operation with JRC and international partners. In addition, a methodology for in-line monitoring of hydrogen quality at the HRS, as well as sampling strategy and methodology for new impurities, gas, particles and liquids, will be evolved. Three European laboratories will be established, capable of measuring all of the contaminants according to ISO 14687 standards, and provide a strong evidence on the quality and reliability on their result. Beyond the project, the three laboratories will offer their services to the European FCH community. In addition, a network of expert laboratories will be set, able to provide qualitative analysis and the first analytical evidence on the presence or absence of these new compounds with potential negative effect to the FCEV. The efficient dissemination and communication improves the resulting data and input for the recommendations for ISO standards of hydrogen fuel. The project and its results will be public, to boost the impact of the project outcomes and to enhance the competitiveness of the European FC industry.	

Topic FCH-04-3-Projects

Topic: FCH-04-3-2017 (Cross-cutting)	**Acronym:** TeacHy
Call: H2020-JTI-FCH-2017-1	**Type of Action:** CSA
Title: Teaching Fuel Cell and Hydrogen Science and Engineering Across Europe within Horizon 2020	
Starting date: 01.11.2017	**End date:** 31.10.2020
Total Cost: 1,248,528.75 €	**EU max. contribution:** 1,248,528.75 €
Coordinator: THE UNIVERSITY OF BIRMINGHAM	
Participants: ▪ TECHNISCHE UNIVERSITEIT DELFT ▪ POLITECNICO DI TORINO ▪ NATIONAL TECHNICAL UNIVERSITY OF UKRAINE IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE ▪ DANMARKS TEKNISKE UNIVERSITET ▪ VYSOKA SKOLA CHEMICKO-TECHNOLOGICKA V PRAZE	▪ ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE ▪ UNIVERSITE LIBRE DE BRUXELLES ▪ UNIVERSITATEA POLITEHNICA DIN BUCURESTI ▪ INSTITUT POLYTECHNIQUE DE GRENOBLE ▪ UNIVERSITY OF ULSTER ▪ KARLSRUHER INSTITUT FUER TECHNOLOGIE
Countries: UK;NL;IT;UA;DK;CZ;CH;BE;RO;FR;DE	
Objectives: As the FCHT industry gradually emerges into the markets, the need for trained staff becomes more pressing. TeacHy2020 specifically addresses the supply of undergraduate and graduate education (BEng/BSc, MEng/MSc, PhD etc.) in fuel cell and hydrogen technologies (FCHT) across Europe. TeacHy 2020 will take a lead in building a repository of university grade educational material, and design and run an MSc course in FCHT, accessible to students from all parts of Europe. To achieve this, the project has assembled a core group of highly experienced institutions working with a network of associate partners (universities, vocational training bodies, industry, and networks). TeacHy2020 offers these partners access to its educational material and the use of the MSc course modules available on the TeacHy2020 site. Any university being able to offer 20% of the course content locally, can draw on the other 80% to be supplied by the project. This will allow any institution to participate in this European initiative with a minimised local investment. TeacHy2020 will be offering solutions to accreditation and quality control of courses, and support student and industry staff mobility by giving access to placements. Schemes of Continuous Professional Development (CPD) will be integrated into the project activities. We expect a considerable leverage effect which will specifically enable countries with a notable lack of expertise, not only in Eastern Europe, to quickly be able to form a national body of experts. TeacHy will offer educational material for the general public (e.g. MOOC's), build a business model to continue operations post-project, and as such act as a single-stop shop and representative for all matters of European university and vocational training in FCHT. The project partnership covers the prevalent languages and educational systems in Europe. The associated network has over 20 partners, including two IPHE countries, and a strong link to IPHE activities in education.	

Topic FCH-04-4-Projects

Topic: FCH-04-4-2017 (Cross-cutting)	**Acronym:** PRESLHY
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Pre-normative REsearch for Safe use of Liquide HYdrogen	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 1,905,862.50 €	**EU max. contribution:** 1,724,277.00 €
Coordinator: KARLSRUHER INSTITUT FUER TECHNOLOGIE	
Participants: ▪ L AIR LIQUIDE SA ▪ HEALTH AND SAFETY EXECUTIVE ▪ INTERNATIONAL ASSOCIATION FOR HYDROGEN SAFETY ▪ INSTITUT NATIONAL DE L ENVIRONNEMENT ET DES RISQUES INERIS ▪ THE UNIVERSITY OF WARWICK	▪ "NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS""" ▪ PRO-SCIENCE - GESELLSCHAFT FUR WISSENSCHAFTLICHE UND TECHNISCHE DIENSTLEISTUNGEN MBH ▪ UNIVERSITY OF ULSTER
Countries: DE;FR;UK;BE;EL	
Objectives: In the proposed project PRESLHY pre-normative research for the safe use of cryogenic liquid hydrogen (LH2) will be performed. The consortium consists of European key organizations from the International Association for Hydrogen Safety HySafe with the relevant background related to LH2 safety research and will be coordinated by Karlsruhe Institute of Technology KIT. The work program duly refers to the outcomes of Research Priorities Workshops commonly organized by IA HySafe, EC JRC, and US DoE. Via HySafe and IEA HIA it will be aligned with other international activities also dedicated to safety issues of LH2, in particular with current research done at Sandia National Laboratory SNL. The results will help to improve the knowledge base and state-of-the-art, which will be reflected in appropriate recommendations for development or revision of specific international standards. So, the main objectives of PRESLHY are to identify critical knowledge gaps and to close these by developing and validating new appropriate models. Based on these results and with the better understanding of the relevant phenomena, specific engineering correlations will be derived which will help to evaluate mitigation concepts and safety distance rules for LH2 based technologies. The derived models and correlations could be directly implemented in new standards ans/or will fill current gaps in risk assessment tools, like the US supported hydrogen risk assessment toolkit HyRAM, and increase their validated scope of application. In general it will remove over-conservative requirements for innovative solutions, allows for cost-efficient safer design and for internationally harmonised, performance based standards and regulations. These objectives are fully aligned with Euroepean scientific-technological interests and strategies and very important to further the safe introduction and scale-up of hydrogen as an energy carrier.	

Topic FCH-04-5-Projects

Topic: FCH-04-5-2017 (Cross-cutting)	**Acronym:** ID-FAST
Call: H2020-JTI-FCH-2017-1	**Type of Action:** RIA
Title: Investigations on degradation mechanisms and Definition of protocols for PEM Fuel cells Accelerated Stress Testing	
Starting date: 01.01.2018	**End date:** 31.12.2020
Total Cost: 2,748,195.00 €	**EU max. contribution:** 2,748,195.00 €
Coordinator: COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	

Participants:

- POLITECNICO DI MILANO
- DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV
- ZENTRUM FUR SONNENENERGIE- UND WASSERSTOFF-FORSCHUNG BADEN-WURTTEMBERG
- BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
- FREUDENBERG PERFORMANCE MATERIALS SE & CO KG
- SYMBIOFCELL SA

Countries: FR;IT;DE

Objectives:

ID-FAST aims at supporting and promoting the deployment of Proton Exchange Membrane Fuel Cell (PEMFC) technologies for automotive applications through the development of Accelerated Stress Tests (AST) together with a methodology allowing durability prediction, thus accelerating the introduction of innovative materials in next generation designs.

The project is founded and focused on two main points: degradation mechanisms understanding and durability prediction improvement via the development and validation of specific ASTs and associated transfer functions.

Degradation investigations will be based on consolidated data (objects with known history and ageing data) from both real systems tested in cars and ID-FAST test program to ensure relevant analysis of failure modes and performance losses together with a mean to validate the developed methodology. Investigation of stressors impact on components degradation and performance losses will give access to the accelerating factor for each single mechanism AST.

Thanks to the expertise of partners, understanding will be ensured by advanced ex-situ and in-situ characterisations to identify and quantify components degradation phenomena, and by modelling and multi-scale simulation tools to investigate the impact of various stressors and to relate causes to performance losses.

Combined AST protocols will be developed and validated with regard to their capability to actually reduce testing time and their relevance assessed by correlation to real world ageing. The methodology developed will allow prediction of stack lifetime and thus will be valuable for the whole automotive fuel cell community.

To achieve its objectives, ID-FAST will benefit from the strong expertise of 8 partners (4 research centres, 1 university, 1 SME and 2 large companies) all along the value chain, and from an Advisory Group gathering industrial companies from components manufacturers to end-users, as well as recognised laboratories from USA and Japan.

List of Calls Fuel Cells and Hydrogen

Topic	Title	Number of funded projects	Total EU-contribution [EUR]
FCH-01-1	Development of fuel cell system technologies for achieving competitive solutions for aeronautical applications	1	5,063,023.00
FCH-01-2	Towards next generation of PEMFC: Non-PGM catalysts	2	5,568,619.38
FCH-01-3	Improvement of compressed storage systems in the perspective of high volume automotive application	1	3,996,943.75
FCH-01-5	Large scale demonstration in preparation for a wider roll-out of fuel cell bus fleets (FCB) including new cities – Phase two	1	25,000,000.00
FCH-01-6	Large scale demonstration of Hydrogen Refuelling Stations and Fuel Cell Electric Vehicle (FCEV) road vehicles operated in fleet(s)	1	4,998,843.00
FCH-01-7	Validation of Fuel Cell Trucks for the Collect of Urban Wastes	1	4,993,851.00
FCH-02-1	Game changer Water Electrolysers	2	3,925,310.00
FCH-02-2	Game changer High Temperature Steam Electrolysers	1	2,998,951.25
FCH-02-3	Reversible Solid Oxide Electrolyser (rSOC) for resilient energy systems	1	2,999,575.25
FCH-02-4	Highly flexible electrolysers balancing the energy output inside the fence of a wind park	1	4,997,738.63
FCH-02-5	Demonstration of large electrolysers for bulk renewable hydrogen production	1	9,998,043.50
FCH-02-6	Liquid organic hydrogen carrier	1	2,499,921.25
FCH-02-7	Development of flexible large fuel cell power plants for grid support	1	4,387,063.75
FCH-02-8	Step-change in manufacturing of Fuel Cell Stack Components	1	3,189,816.00
FCH-02-9	Development of next-generation SOFC stack for small stationary applications	1	2,996,873.75
FCH-02-10	Transportable FC gensets for temporary power supply in urban applications	1	4,999,945.76

FCH-02-11	Validation and demonstration of commercial-scale fuel cell core systems within a power range of 10-100kW for selected markets/applications	1	7,486,954.75
FCH-02-12	Demonstration of fuel cell-based energy storage solutions for isolated micro-grid or off-grid remote areas	1	4,995,950.25
FCH-04-1	Limiting the impact of contaminants originating from the hydrogen supply chain	1	3,499,867.50
FCH-04-3	European Higher Training Network in Fuel Cells and Hydrogen	1	1,248,528.75
FCH-04-4	PNR for a safe use of liquid hydrogen	1	1,724,277.00
FCH-04-5	Definition of Accelerated Stress Testing (AST) protocols deduced from understanding of degradation mechanisms of aged stack components in Fuel Cell systems	1	2,748,195.00
Total		24	114,318,292.52

List of Abbreviations

Type of Action

CSA	Coordination and Support Action
IA	Innovation Action
RIA	Research and Innovation Action

Others

FCH	Fuel Cells and Hydrogen
H2020	Horizon 2020
JTI	Joint Technology Initiative
JU	Joint Undertaking
NCP	National Contact Point